



# WATER EFFICIENCY STANDARDS FOR STATE BUILDINGS AND INSTITUTIONS OF HIGHER EDUCATION FACILITIES

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**January 2011**

**Effective Day: September 1, 2011**



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## ACKNOWLEDGEMENTS

The State Energy Conservation Office (SECO) wishes to thank the tireless representatives of various state agencies and higher educational institutions that provided technical, policy and regulatory advice during the development of the updated Water Efficiency Standards. SECO would like to acknowledge the members, as well as their respective organizations, for their time and invaluable input.

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## BACKGROUND

The Standards are an update of the Texas Water Guidelines. In 2001, the 77th Texas Legislative session directed SECO to develop a set of water efficiency standards for state-funded buildings (Texas Government Code Chapter 447.004). With help from the Texas Water Development Board (TWDB) and the City of Austin Water Conservation Office, SECO developed guidelines in 2002 that have been revised here.

The Standards should be followed for new state facilities and major renovation projects as defined by Texas Administration Code Chapter 19, Subchapter C. The Standards would also apply when purchasing new related equipment to replace existing equipment, for making modifications to existing systems, or equipment that equals more than half the original purchase price of the equipment. The Standards should also be used for upgrading existing equipment that works but is nearing the end of its life expectancy. A systematic approach should be used when examining water use and using the Standards. The final goal of the Standards is to balance water, wastewater, energy and related costs to achieve the lowest life cycle costs when purchasing new equipment, replacing old equipment or making modifications to existing equipment.

## PURPOSE OF WATER CONSERVATION STANDARDS

These Water Conservation Standards (the Standards) set targets for water conservation and water-use efficiency. These Standards also provide guidance on effective conservation measures to meet the statewide goals identified in Chapter 447 of the Texas Government Code.

Water conservation is defined in Texas Administrative Code 288 as “a strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water and for preventing the pollution of water.” In this document the terms *water conservation* and *water efficiency* are used interchangeably.

This document focuses on standards based on water conservation best management practices (BMP). BMPs are efficiency measures that save a quantifiable amount of water, either directly or indirectly, and can be implemented within a specific time frame. The Standards are achievable, implementable and practical measures that should be used in the planning, construction and renovation of buildings used by state agencies and higher education institutions.

## INTRODUCTION

Many communities in Texas have investments in water conservation and efficiency. These investments have resulted in reductions in per capita demand and water supply system efficiency. Significant opportunity still exists for greater water-use efficiency that will result in economic, public health and environmental benefits.

Texas' economy is directly linked to its natural resources. Water is a critical natural resource that is affected by rainfall and development. Seasonal rainfall varies significantly from year to year. Development and weather can severely deplete water supplies.

Water conservation and efficiency is critical to ensuring the state's long-term economic health. It is becoming increasingly important as water demand rises.

## IMPLEMENTATION OF THE WATER CONSERVATION STANDARDS

These Standards should be used in all programs affecting the planning and management of Texas' water resources. Water-use conservation standards should also be included in all construction, rehabilitation and facility development activities statewide. The Standards and recommendations outlined in this document reflect the most current technical and operational knowledge about water-use efficiency.

## OVERVIEW

Water conservation and efficiency affects everyone. It is up to each segment of the water-using community to do its part to understand and support the need for water conservation.

The Standards can be guidelines for all water suppliers and users, including consumers, businesses, industries and public agencies statewide. The Standards cover key areas of water supply planning and management, and indoor and outdoor water use.

The Standards' goals are:

1. Implement water conservation in all new state-owned buildings to accurately account for water use and demonstrate water-saving techniques and concepts to the public.
2. Integrate water conservation and efficiency measures into all aspects of state-owned buildings including: major renovation projects; purchase of new related equipment to replace existing equipment; modifications to existing systems; and upgrades to existing equipment.
3. Maximize the efficiency of public water supply systems.
4. Promote public awareness of the long-term economic and environmental benefits of conserving water.

## DEFINITIONS

*Alternate water source* is defined as a source of non-potable water. Examples of alternate water sources are: rainwater, storm water, condensate, treated graywater, process reject water, blowdown, foundation drain water, etc.

*Automatic shut-off device* is defined as an active system that stops the flow of water automatically when a leak is detected or a programmable system that stops the flow of water when the equipment is not in use.

*Blowdown* is defined as the portion of the circulating water flow in a heat transfer process that is removed in order to maintain the amount of dissolved solids and other impurities at an acceptable level.

*Closed loop system* is defined as a system that has no contact with the outside environment.

*Economic feasibility study* is defined as a cost benefit analysis of a system based on the expected life, cost, maintenance and materials of the system as compared with the cost of water saved. For automatic implementation, the cost benefit analysis will yield a breakeven point of no more than one-third the expected life of the system, which shall be a maximum of 30 years.

*EPA Energy Star* is defined as a joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) helping to save money and protect the environment through energy-efficient products and practices.

*EPA Water Sense* is defined as an EPA-sponsored partnership program that seeks to protect the future of the nation's water supply by promoting water efficiency and enhancing the market for water-efficient products, programs and practices.

*Graywater* is defined as untreated, non-toilet, household water including water from bathroom sinks, showers and baths.

*Make-up water* is defined as the water feed needed to replace that which is lost in a heat transfer process by evaporation or leakage in a close loop system.

*Non-potable water* is defined as water that is not suitable for drinking.

*Once through cooling* is defined as water that is pumped through heat exchange equipment and then discharged into the environment.



*Potable water* is defined as water that is fit for consumption by humans and other animals.

*Rainwater harvesting* is defined as the capture, diversion, and storage of rainwater for a variety of purposes including landscape irrigation, drinking and domestic use, aquifer recharge and storm water abatement.

*Reclaimed water* is defined as water from domestic or municipal wastewater that has been treated to a quality suitable for beneficial use.

*Recycled water* is defined as water, which as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.

*Reuse* is defined as treated wastewater that can be used for beneficial purposes.

*Self-closing* is defined as a device, usually in a faucet or nozzle, which must be turned on by the user by pushing or pulling and is turned off when the user releases the handle or tap.

## ABBREVIATIONS

BMP – Best Management Practices

EPA – Environmental Protection Agency

F – Fahrenheit

MaP – Maximum Performance

gpd – gallons per day

gpf – gallons per flush

gph – gallons per hour

gpm – gallons per minute

gpv – gallons per vehicle

ppm – parts per million

psi – pounds per square inch

sqft – square feet

SECO – State Energy Conservation Office

TCEQ – Texas Commission on Environmental Quality

TWDB – Texas Water Development Board

## 1.0 IRRIGATION AND LANDSCAPE DESIGN

### STANDARDS FOR IRRIGATION

1. Automatic irrigation systems shall comply with TCEQ's Water Code, TCEQ's Occupation Code Chapter 1903, Texas Administration Code Title 30, Chapter 344 and all local requirements.
2. Irrigation shall be separately metered (see Pumps and Metering)
3. Irrigation shall employ drip, trickle, micro, low-arching or other water-conserving technology where possible.
4. Adjustable flow control valves shall be required on circuit remote control valves.
5. Automatic irrigation systems shall be equipped with a flow meter that stops system operation to prevent unintended waste of water from damaged or malfunctioning components.
6. Automatic irrigation systems shall be equipped with a controller capable of dual or multiple programming. Controllers shall have multiple cycle start capacity and flexible calendar programming, including the capability by day of the week or day to night interval watering.
7. Automatic irrigation systems shall be equipped with rain and freeze sensor shut-off devices.
8. Pressure regulating devices shall be required where static pressure exceeds manufacturer's recommended operating range. This component should be installed at the control valve.
9. Serviceable check valves shall be required where elevation differential may cause low head drainage adjacent to paving areas.
10. Sprinkler head spacing shall be designed for head-to-head coverage or heads shall be spaced as per manufacturer's recommendations and adjusted for prevailing winds. The system shall be designed for minimum run-off.
11. Sprinklers shall not be placed along curbs, in parkways or planting islands less than six feet wide.
12. Alternate sources of non-potable water shall be explored and implemented where economically feasible.
13. Appropriate signage is required and shall identify non-potable water use.

### STANDARDS FOR LANDSCAPE DESIGN

1. To maximize water retention, all projects shall include soil analysis and specifications appropriate to the geographic region. All landscape planting selections must be appropriate for the soil as analyzed and amended.

2. Acceptable topsoil shall be free of weeds, stones larger than one inch in diameter and a minimum of 30 percent organic matter. Up to 20 percent washed sand may be added to clay-type soils.
3. Turfgrass and planting bed areas shall have a minimum top soil depth as recommended by the regional Texas AgriLife Extension Service.
4. Non-turf planted areas shall have two inches or more of mulch and cover soil surfaces to minimize soil moisture evaporation. To minimize water use, fall installation of landscape is highly recommended, with winter and spring installations acceptable. Summer installation is strongly discouraged.
5. Plants recommended by the regional Texas AgriLife Extension Service shall be considered desirable.
6. Plants having similar water needs shall be grouped together and selected based on use, soil conditions, sun and shade conditions, adaptability to geographic and climatic conditions and the ability to survive normal rainfall or minimal irrigation.
7. Irrigated turfgrass shall not exceed 50 percent of landscaped areas. Exceptions: dedicated athletic fields, golf courses and driving ranges.
8. Turfgrass selection shall be determined by facility need and geographic and climatic conditions and the ability to survive normal rainfall or minimal irrigation.
9. Preservation of native plants is encouraged. Such plants include, but are not limited to:
  - a. Plants that are threatened or endangered
  - b. Specimen plants or exceptional examples of a particular species
  - c. Plants that readily survive relocation and are useful in new or existing landscapes
10. The landscape design shall be coordinated with the storm water design to ensure that the maximum amount of water is retained on the property through the use of storm water BMP's such as berms, swales, terraces, rain gardens and proper contouring of landscape.

## 2.0 HEATING, VENTILATION AND AIR CONDITIONING

### STANDARDS FOR HEATING, VENTILATION AND AIR CONDITIONING

1. Performance and procedural standards will be follows for maximum energy and water conservation allowed by the latest and most cost-effective technology that is consistent with the requirements of public health, safety and economic resources, as stated in SECO Government Code Chapter 447 Design Standards, Section 447.004.
2. Once-through cooling is prohibited for all heating, ventilation and cooling equipment.
3. An economic feasibility study should be conducted assessing whether harvesting and delivery can be accomplished through gravity drainage or pumping, if condensate drainage would need to be treated before reuse and any other cost impact.
4. Closed loop, water-cooled equipment shall be used where possible with the exception of open-cell cooling towers.
5. Cooling towers and boiler chemical contracts shall achieve at least 3.5 cycles of concentration where make-up water is more than 200 ppm of hardness.
6. Cooling towers and boiler chemical contracts shall achieve at least five cycles of concentration where makeup water is less than 200 ppm of hardness.
7. Steam condensate shall be returned to the boiler.
8. Cooling towers and steam boilers shall be fitted with conductivity meters and makeup meters.
9. Cooling towers shall be fitted with overflow sensors and blowdown meters to manage make-up water.
10. Steam boilers shall be fitted with blowdown heat exchangers to transfer heat to feed water.
11. Cooling tower drift eliminators shall be utilized and maintained to minimize water loss.
12. An economic feasibility study should be conducted to assess whether hybrid towers and/or geothermal (ground coil) heat pump units and the use of dry cooling variable fluid volume systems should be installed.
13. When examining the cost benefit analysis of dry versus wet cooling, all additional costs of cooling tower use should be considered, including:
  - a. Energy needed to pump water in the chilled water and cooling tower loops,
  - b. Cost of water and wastewater,
  - c. Cost of cooling tower water treatment,
  - d. Cost of labor to operate the towers,
  - e. Capital replacement cost associated with cooling towers compared with dry cooling,

- f. Impact of a discharge with a high total dissolved solid content on the environment including pretreatment and Total Maximum Daily Loading (TMDL) implications, and
- g. The benefits of redundant systems offered by the use of many smaller air-cooled or ground-cooled systems.

### 3.0 REFRIGERATION AND WATER TREATMENT

#### STANDARDS FOR REFRIGERATION

1. Any water-cooled refrigeration system shall be supplied by a re-circulating system.
2. All ice machines shall meet EPA Energy Star certification standards.

#### STANDARDS FOR WATER TREATMENT

1. If water softening is used, regeneration shall be controlled by actual hardness or by a flow volume control that is based on the hardness of the water to be softened.  
Softeners that use timers for recharging are prohibited.
2. Central reverse osmosis or nano-filtration systems shall reuse waste water for landscape irrigation or other beneficial purposes. (Beneficial purposes include but are not limited to the following: other process use, cooling tower makeup, toilet or urinal flushing, vehicle rinse, laundry and aesthetic fountain makeup).
3. Central distillation systems shall recover 85 percent of feed water.

#### 4.0 RAINWATER HARVESTING, RECLAIMED WATER, RECYCLED WATER, AND REUSE

1. Rainwater harvesting, recycled water and reuse systems shall comply with all state and local laws regarding public safety and health as stated in the Texas Government Code 447.004.
2. On-site reclaimed system technologies, including rainwater harvesting, condensate collection, or cooling tower blowdown, or a combination thereof, for non-potable indoor use and landscape watering shall be incorporated into the design and construction of each new building with a roof measuring at least 10,000 square feet. Alternate on-site water sources include, but are not limited to: rainwater, storm water, air conditioner condensate, reverse osmosis and nano-filtration reject water, foundation drain water, pool backwash water, pool water discharged to maintain water quality, gray water, wastewater treatment effluent and steam condensate that is not returned to the boiler.
3. SECO shall be notified and provided with documentation if design standards are not practical.

#### STANDARDS FOR RAINWATER HARVESTING

1. Structures connected to the public water supply and containing a rainwater harvesting system for indoor use shall comply with Texas Administration Code 30 Chapter 290, Subchapter D, and all local requirements.
2. An economic feasibility study should be conducted to assess whether harvesting and delivery can be accomplished through gravity drainage or pumping, or if rainwater would need to be treated before reuse, as well as any other cost impact.
3. Monthly rainfall rates and expected run-off capture shall be analyzed to size the catchment area and the storage capacity to meet water demand through the longest expected interval without rain. Average precipitation rates and historical maximum number of dry days can be found in TWDB's *The Texas Manual on Rainwater Harvesting, Third Edition*, Chapter 4: Water Balance and System Sizing, and Appendix B: Rainfall Data.
4. Plumbing and installation guidance for installing a rainwater harvesting system can be found in "Rainwater Catchment Design and Installation Standards," from the American Rainwater Catchment System Association and the American Society of Plumbing Engineers.,



#### STANDARDS FOR RECLAIMED WATER, RECYCLED WATER AND REUSE

1. On-site reclaimed, recycled and reuse water systems shall be designed, installed and implemented according to Texas Administrative Code Title 30, Chapter 210, and shall comply with local requirements.
2. On-site graywater reuse systems shall be designed, installed and implemented according to Texas Administrative Code Title 30, Chapter 285, Subchapter H, and shall comply with local requirements.

## 5.0 PLUMBING FIXTURES

### STANDARDS FOR PLUMBING FIXTURES

1. All plumbing fixtures, toilets, urinals, faucets and showerheads shall comply with state plumbing standards as administered by TCEQ as well as EPA's WaterSense Performance Standards, where applicable.
2. Water closets with flushometer valve or tank-type toilets shall have a flow rate no greater than 1.28 gpf. All toilet fixtures shall be rated for 1,000 grams or 1.28 gpf as certified by the latest Maximum Performance Test.
3. Flush urinals shall have a flow rate no greater than 0.25 gpf.
4. Faucets in public lavatories shall be fitted with aerators that have a flow rate no greater than 0.5 gpm where the pressure is greater than 25 psi. Lavatory faucets in public restrooms shall be self-closing or shall be equipped with automatic shut-off devices.
5. Showerheads used for non-medical purposes, as in dorms, locker rooms, etc., shall be certified to the EPA WaterSense criteria.
6. All water fountains shall be self closing.
7. All water pipes subject to freezing conditions shall be installed with appropriate freeze protection devices.
8. Special plumbing fixtures other than those mentioned above shall be chosen based on water and energy efficiency and functionality.
9. Signage requesting that leaks and other plumbing problems be promptly reported to the appropriate building management authority shall be placed in each restroom, locker room, kitchen, laundry, pool and other high water-use area. The signage shall be labeled with a phone number to report such problems.
10. Non-potable water may be used for flushing in new buildings where plumbing codes permit.

## 6.0 LAUNDRY

### STANDARDS FOR LAUNDRY

1. Commercial and residential clothes washing equipment shall meet EPA Energy Star certification standards.
2. Clothes washers that have double dump valves and equipment of 150 pounds capacity or greater shall be equipped so that the final rinse water can be reused in the first flush wash.
3. An economic feasibility study should be conducted that assesses whether the use of ozone and water reclamation systems is feasible.
4. Lint capture systems shall use dry capture or wet systems that minimize water use by only using reclaimed or other on-site water sources.
5. Coin and card type washers shall use no more than 5.5 gallons per cubic foot.

## 7.0 FOOD SERVICE

### STANDARDS FOR WAREWASHING

1. Fill and dump warewashing equipment is prohibited.
2. All warewashing equipment shall meet EPA Energy Star certification standards.
3. Flight type dishwashers shall have a flow rate no greater than 165 gph.
4. Kitchen pre-rinse spray valves shall be self-closing and meet EPA Energy Star certification standards.
5. Dipper wells shall be equipped with flow restrictors and shall have a flow rate no greater than 0.3 gpm.
6. All faucets in food prep areas shall be self-closing.

### STANDARDS FOR GARBAGE DISPOSALS

1. Manual scraping and scrapping baskets shall be used instead of garbage grinders and disposals.
2. All garbage disposals shall be air-cooled.
3. Manual pre-wash units shall have shut-off valves that turn water off when the nozzle is not in operation.
4. All garbage disposals shall be equipped with solenoid valves that shut off water flow when not in use.
5. If a fresh water trough or pulper system is necessary, cold water shall be used and a timer shall be installed to shut off the system after 15 minutes of operation or no load and have a flow rate no greater than 2.0 gpm.

### STANDARDS FOR STEAMERS, STEAM TABLES AND COMBINATION OVENS

1. Steamers shall be self-contained and boilerless and shall not have a direct connection to a potable water supply.
2. Steamers shall have a flow rate no greater than 2.0 gph when in full operation mode.
3. Steam tables shall use dry heat.
4. Combination ovens shall meet EPA Energy Star certification standards with a maximum water use rate of 10.0 gph in full operational mode.

## 8.0 PUMPS AND METERING

### STANDARDS FOR PUMPS AND METERING

1. Water pumps shall have a mechanical seal unless prohibited by code.
2. All buildings intended for daily occupation or for water-using equipment operation shall be metered separately with investment grade meters and records of water use shall be maintained by the appropriate agency.
3. All cooling towers, evaporative cooling systems and irrigation systems installed in new buildings shall be separately metered, and records of water use shall be maintained by that agency.
4. Any single activity or piece of equipment at a facility that accounts for more than 20 percent of the total water use at that facility or does not produce wastewater, shall be metered separately and records of water use shall be maintained by that agency.
5. Subtenant space in excess of 50,000 square feet shall be sub-metered and records of water use shall be maintained by that agency.
6. Any project, such as car washes or aquariums, within a building using more than 1,000 gpd, shall be sub-metered and records of water use shall be maintained by that agency.

## 9.0 AUTO SERVICES AND VEHICLE WASHING

### STANDARDS FOR AUTO SERVICES

1. New facilities shall provide secondary containers to catch spills, leaks and drips from stored liquids and solvents.
2. Shop floors shall be sealed.
3. All hoses and water using equipment shall have auto shut-off and solenoid valves installed.
4. All facilities shall use pressure washers instead of hose-type cleaning.

### STANDARDS FOR VEHICLE WASHING

1. Water softener recharge cycle timers are prohibited. Recharge cycles shall be controlled by instruments that measure volume of water treated or the actual quality of the water softened.
2. Deionizing equipment shall be used for water softening instead of reverse osmosis treatment.
3. Reject water shall be piped to a reclamation system and used for pre-soak, undercarriage, and/or initial wash.
4. All conveyor and drive-through type washes shall be equipped with re-circulation or reuse equipment.
5. Chamois wringer faucets shall be self-closing.
6. In-bay hand held spray wash equipment, including spray wands and foaming brushes, shall have a flow rate no greater than 3.0 gpm and shall be equipped with trigger shut-off valves.
7. All pressure wash equipment shall be equipped with unloader valves.
8. All pressure wash equipment shall be equipped with weep holes or other devices to allow for drainage and pressure surges.
9. Conveyor and drive-through type washes shall use no more than 15 gallons of makeup water per vehicle washed for automobiles, pickup trucks and small vans and shall have water recirculation systems.
10. Conveyor and drive-through type washes shall have a flow rate no greater than 40 gpm washed for buses and tractor-trailer rigs.

## 10.0 LAB FACILITIES

### STANDARDS FOR LAB FACILITIES INCLUDING PHOTOGRAPHY AND MEDICAL

1. Once through cooling with potable water of any laboratory, medical or photographic equipment is prohibited.
2. Dry hood scrubber systems shall be used where applicable. If a wet hood scrubber system must be used, then a water recirculation system shall be equipped to the system.
3. Perchlorate and fume hood wash-down systems shall be installed with self-closing valves.
4. Steam sterilizer discharge of condensate or hot water shall be fitted with water tempering devices that control water temperature to a maximum of 140 degrees F to a sanitary waste drain and shall comply with International Plumbing Code Chapter 8: Section 803 – Indirect/Special Wastes.
5. Steam sterilizers shall be equipped with a mechanical vacuum instead of a Venturi-type vacuum.
6. Sterilizers shall be installed with a re-circulating cooling system or the condensate shall be recovered for other on-site uses.
7. Dry vacuum pumps shall be used unless prohibited by local fire and safety codes.
8. Reverse osmosis or nano-filtration reject water shall not exceed 60 percent of feed water and should be used as scrubber feed water or for other beneficial uses on site.
9. Digital imaging shall be used for new radiography, x-ray and photo processing.
10. All new film processor units for x-ray frames greater than six inches shall use a film processor water-recycling unit.

## 11.0 POOLS, SPAS AND SPECIAL WATER FEATURES

### STANDARDS FOR POOLS AND SPAS

1. Pools and spas shall be equipped with re-circulating filtration equipment and shall sub-meter the makeup water.
2. Pools with capacity of 50,000 gallons of water or less shall use cartridge filter systems. The cartridges shall be the reusable type.
3. In-ground pools with splash troughs shall drain back into the pool system.
4. Pools and spas shall be covered when not in use where practical.

### STANDARDS FOR SPECIAL WATER FEATURES

1. Water used for start-up and make-up water in new ornamental fountains or other new ornamental water features shall be supplied by alternate water sources or municipally-reclaimed water. If alternate on-site sources of water or municipally reclaimed water are not available within 500 feet of the building project site, potable water is allowed to be used for water features with less than 10,000-gallon capacity.
2. New ornamental fountains or other new ornamental water features shall be equipped with meters and leak detection devices that shut water feature off if a leak greater than one gph is discovered.
3. New ornamental fountains or other new ornamental water features shall be installed with a re-circulating system.



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